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Automated Sandblaster

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Automated Sandblaster

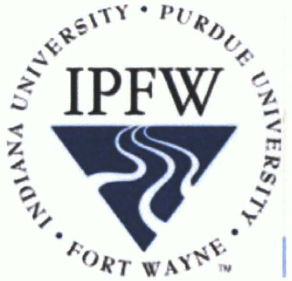
Final Project Report

April 29, 2013

Submitted by: Michael Denney

Created For: Professor Paul Lin
Project Faculty Advisor: Gary Steffen
ENGW 421 Technical Writing Project
To Fulfill B.S. Electrical Engineering Technology Degree Requirement

Submitted to:
Paul I. Lin, Professor of ECET 491 Senior Design II



Department of Electrical and Computer Engineering Technology
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Indiana University-Purdue University Fort Wayne, Indiana

Abstract

The purpose of this report is to review, define, and provide an in depth analysis of the implementation of my Senior Design Project, the Automated Sandblaster. The Automated Sandblaster was a means to significantly improve our ability to increase business and therefore, profit. The extra time saved is used to increase labor time in other areas throughout the company. The project also eliminated the harmful inhalation of fine glass particle beads by the laser operators. As well, the operators do not have to stay in the non-climate controlled shop building to manually operate the replaced manual sandblaster. The benefits of the new automated sandblaster are both immediate and long-term. The immediate benefits are because of the safer environment for the operators and instant work-load increase. The long-term benefits will be the profit that will eventually generate from the labor time saved and extra business.

Key Words

Analysis
Automated
Inhalation
Benefits
Safer
Profit

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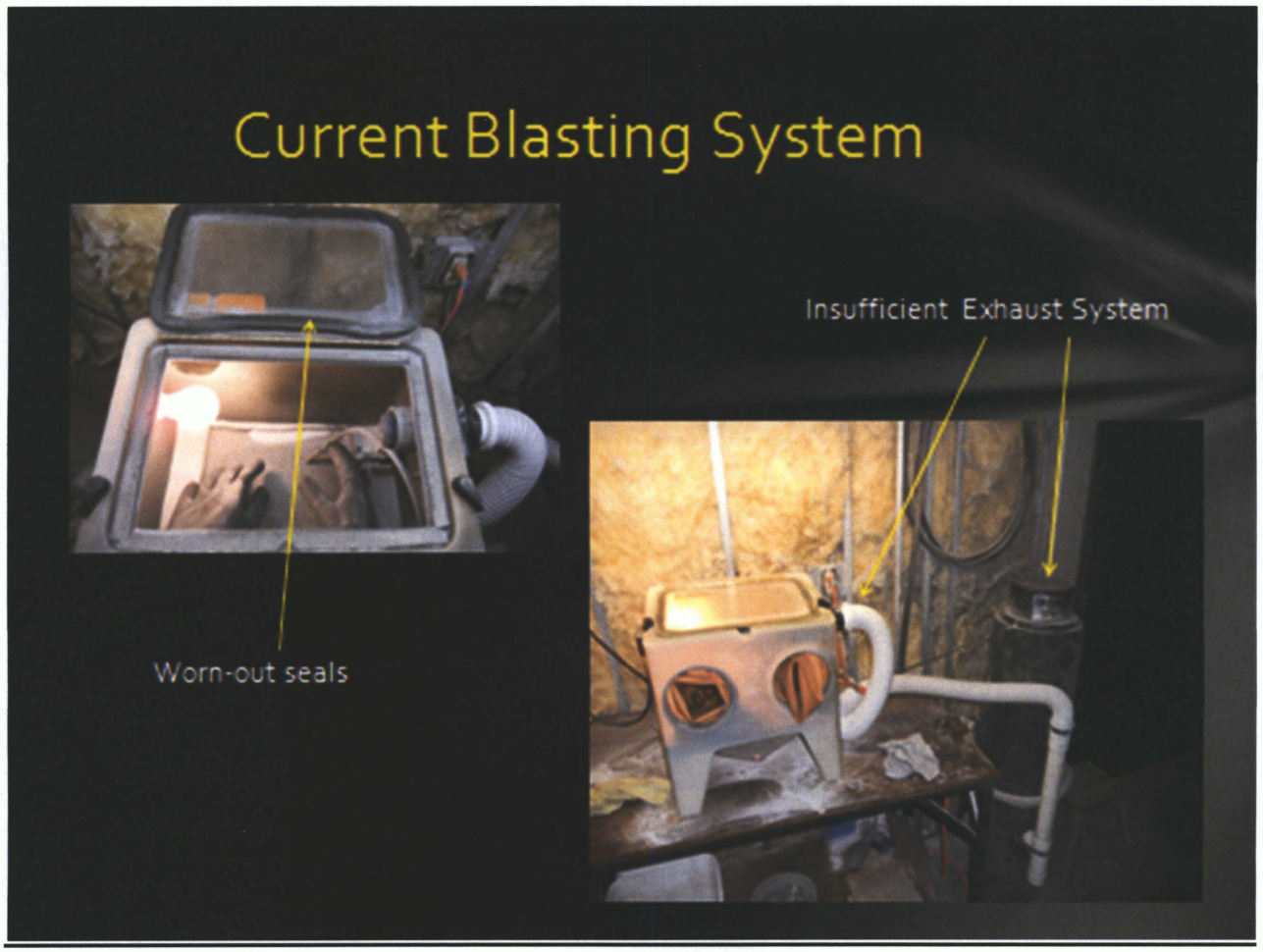
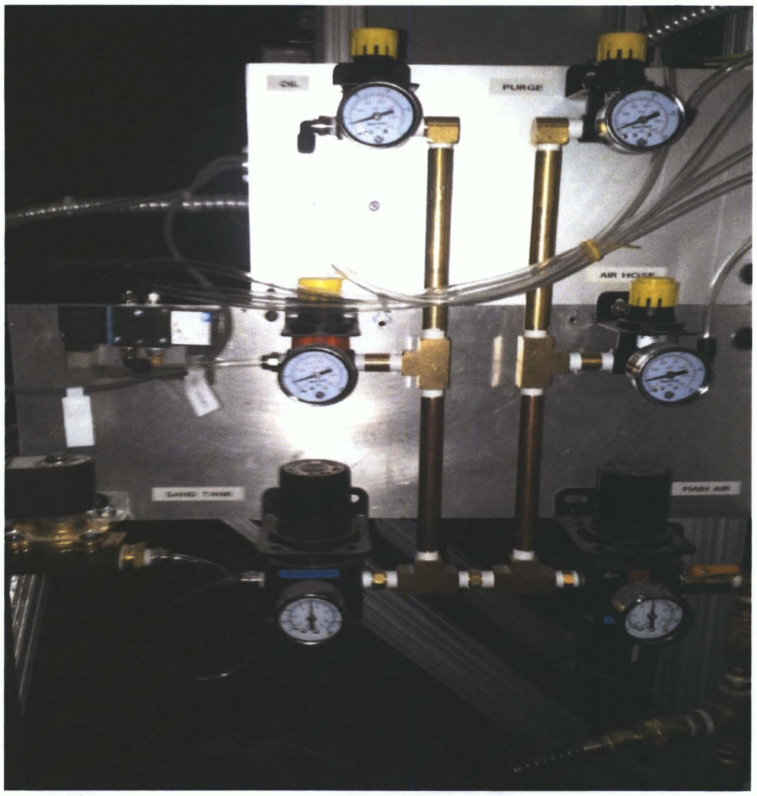


Figure 1: Replaced sandblasting system



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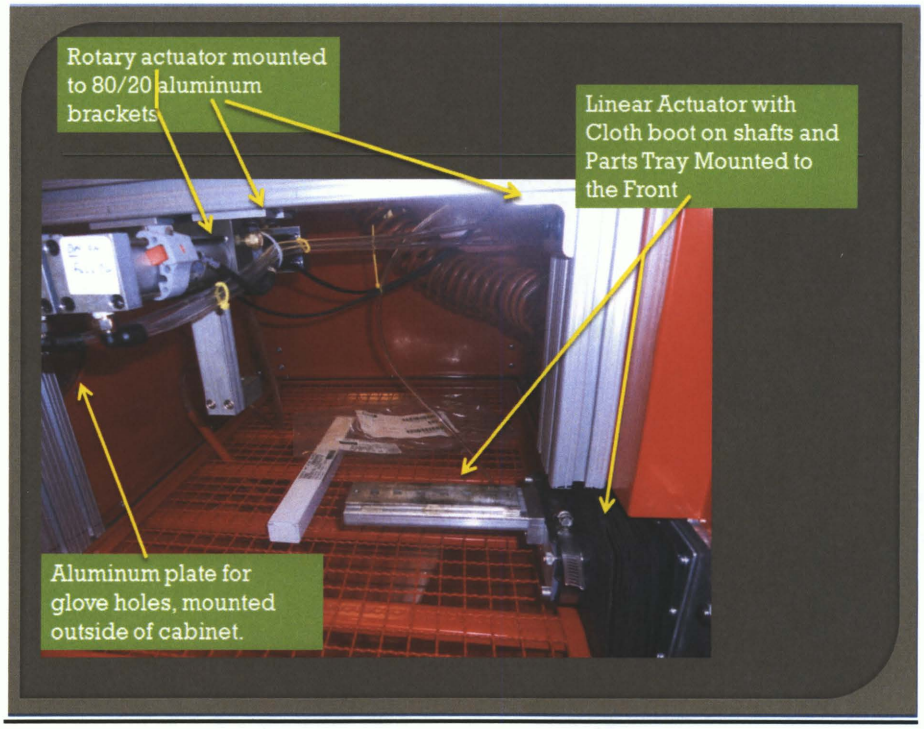

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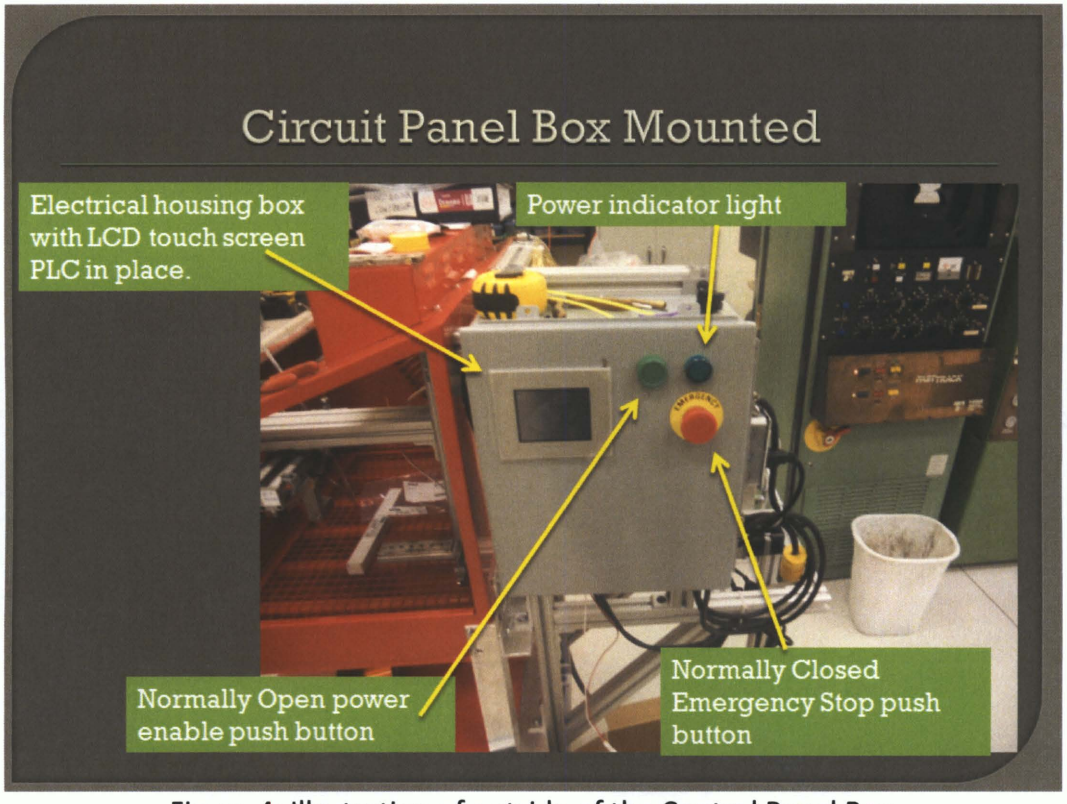

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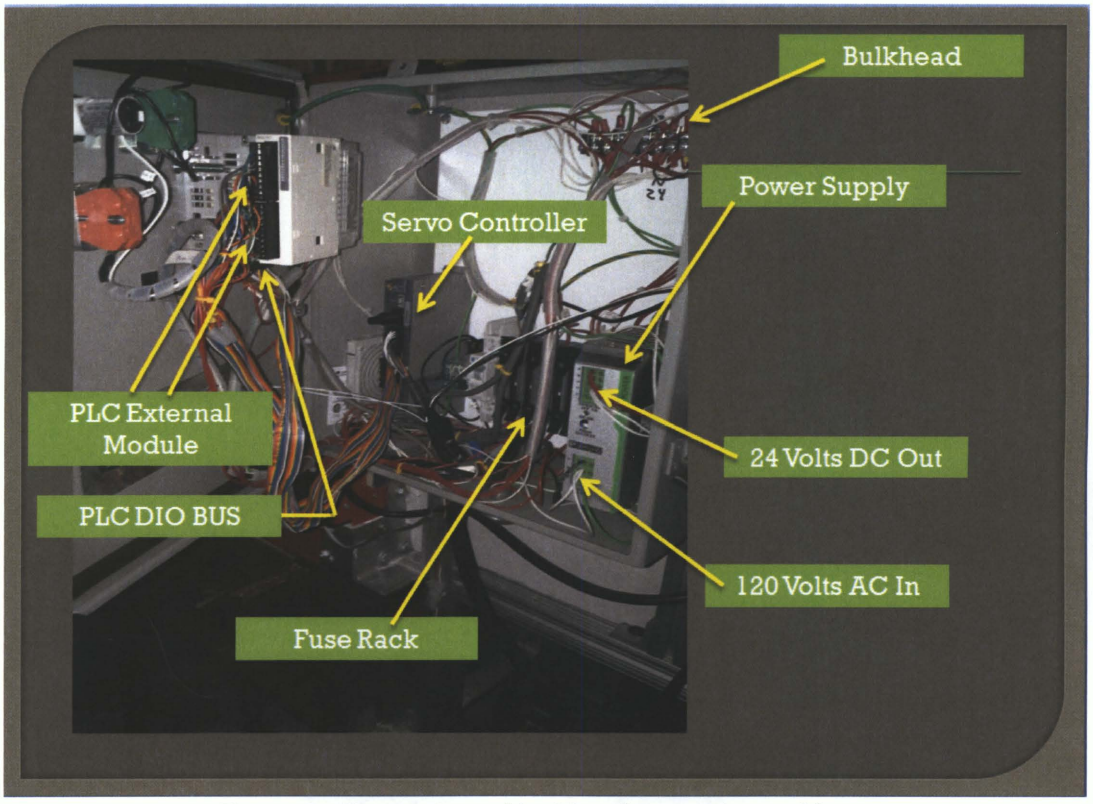

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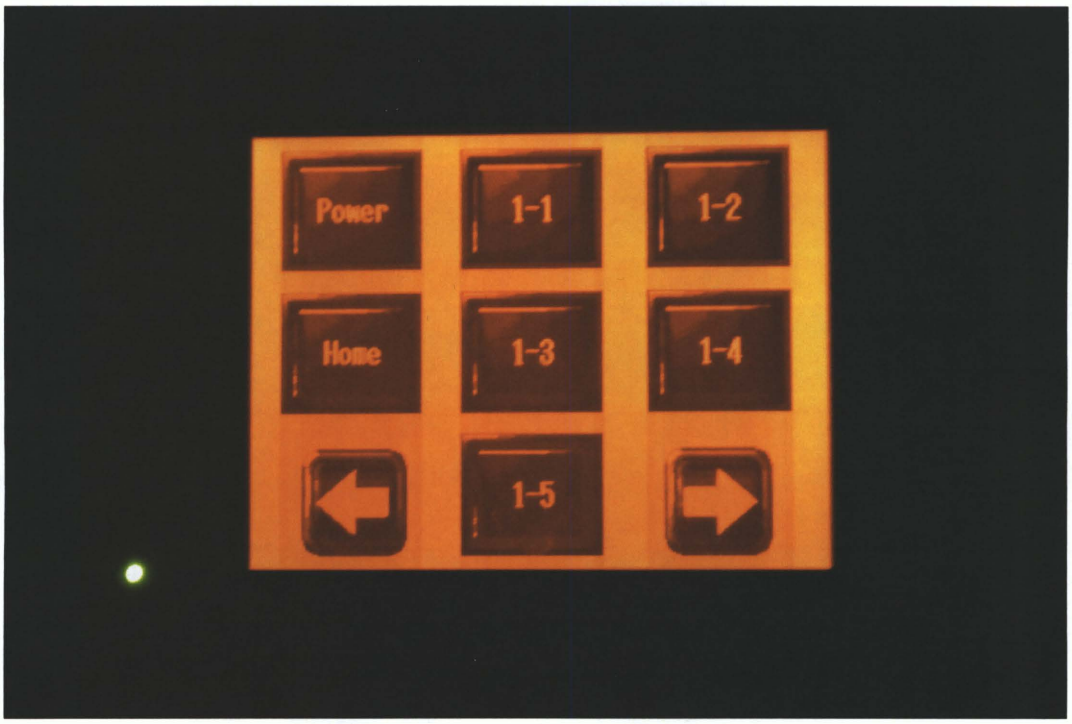

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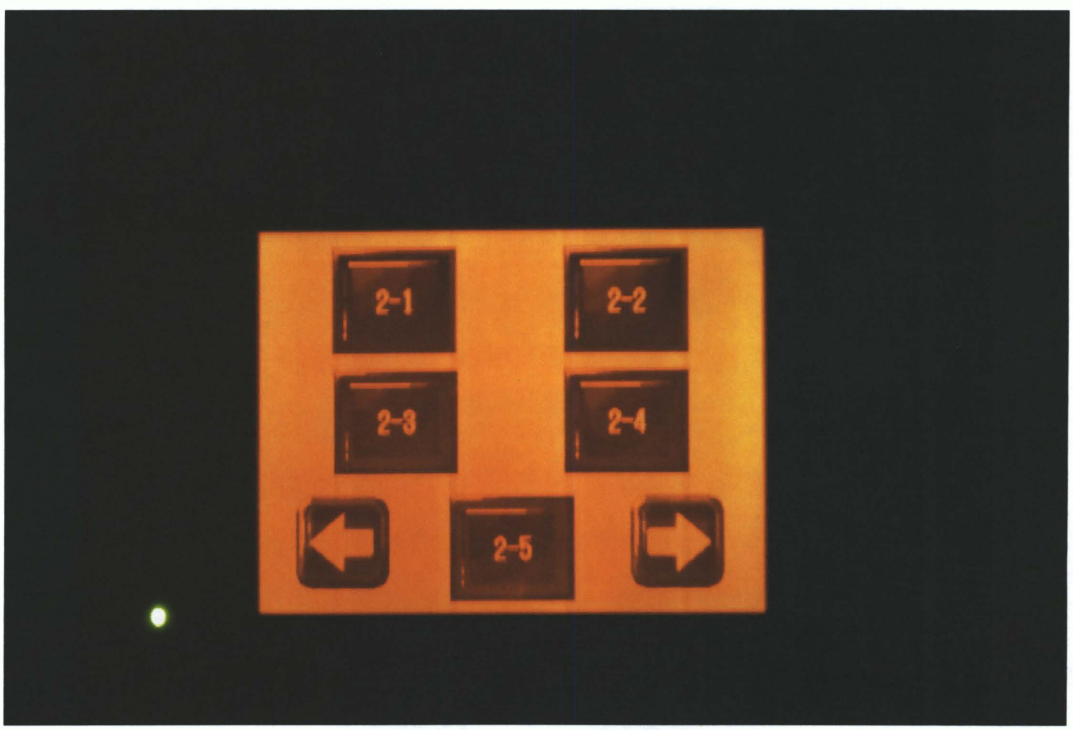

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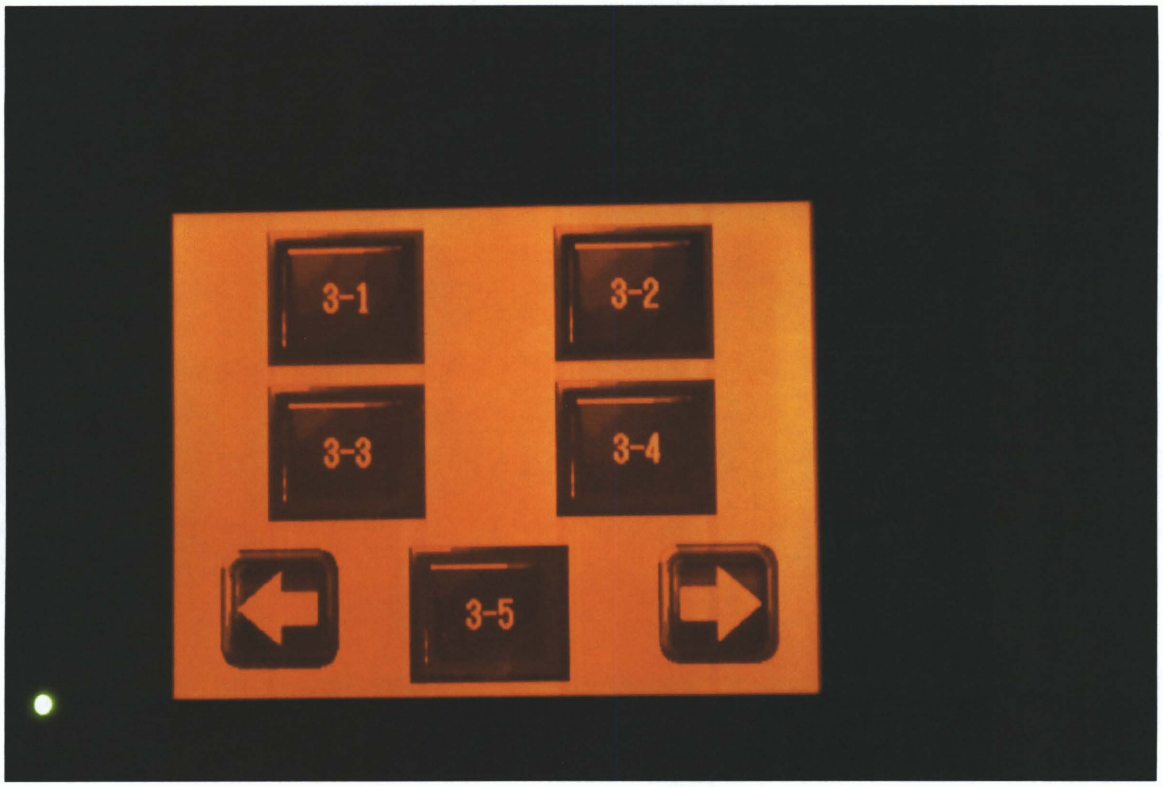

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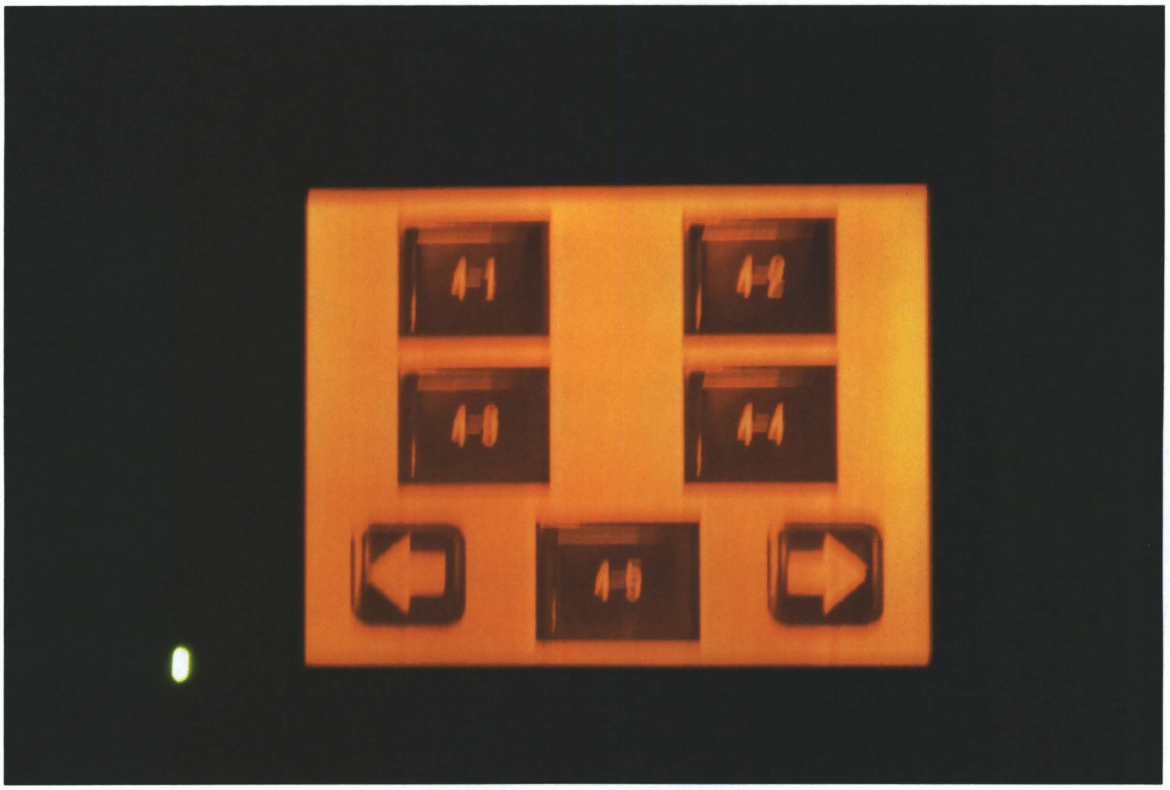

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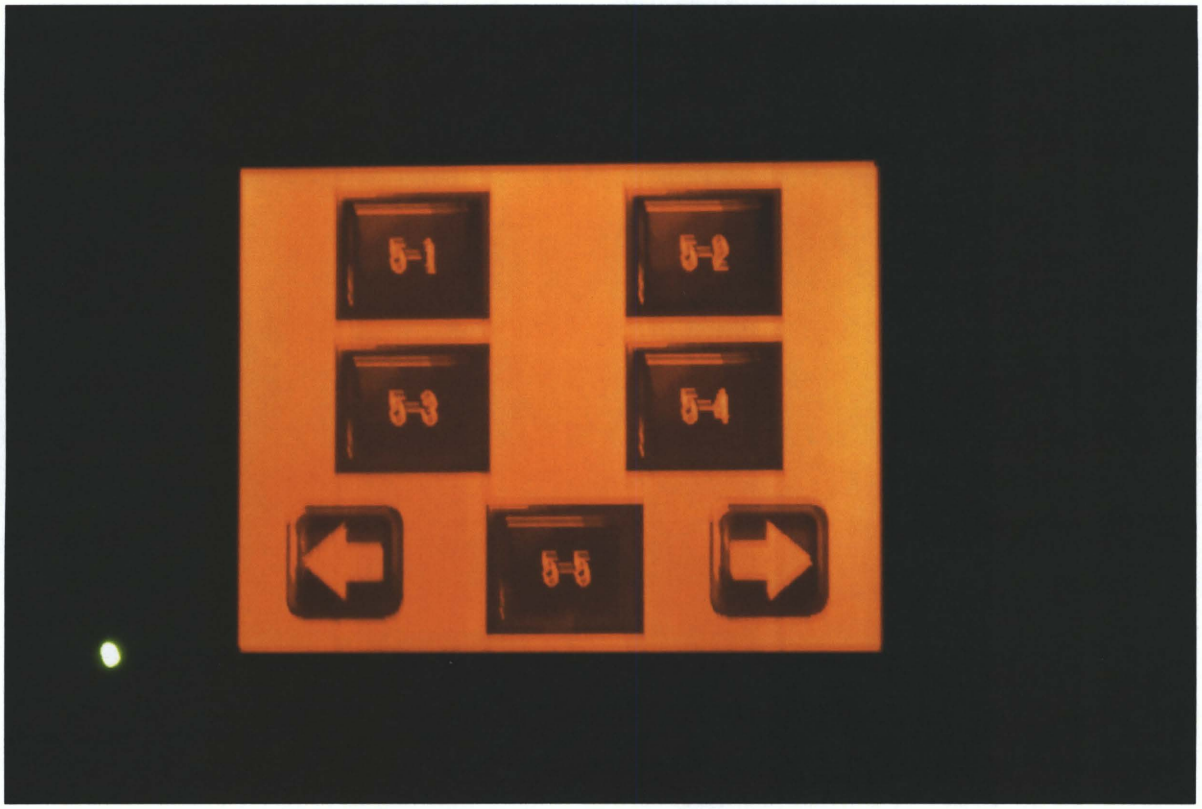

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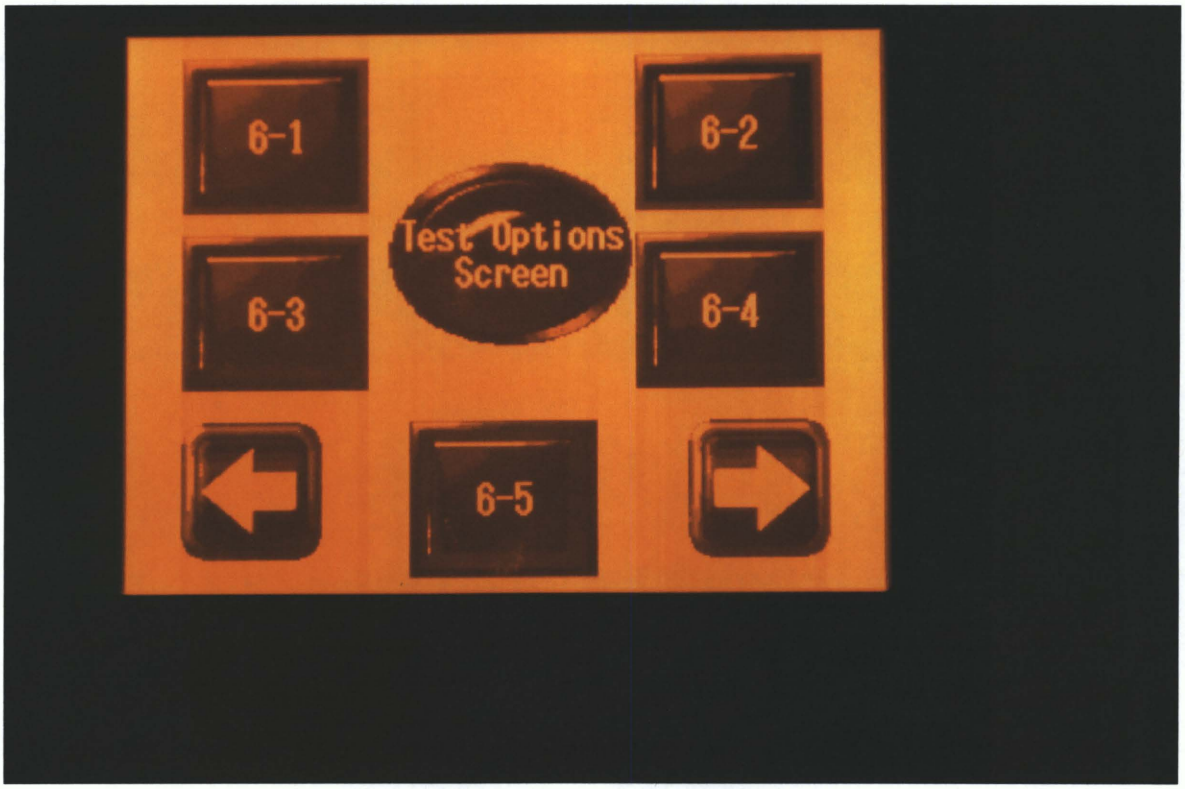

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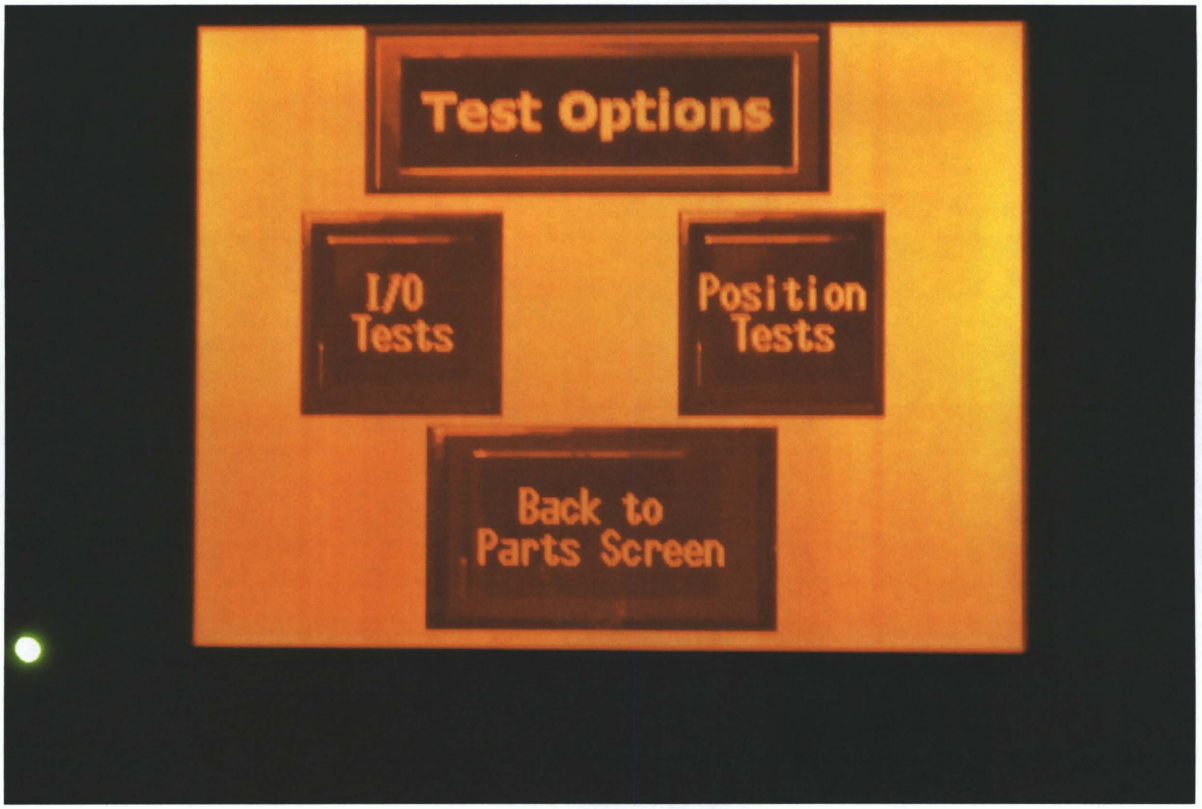

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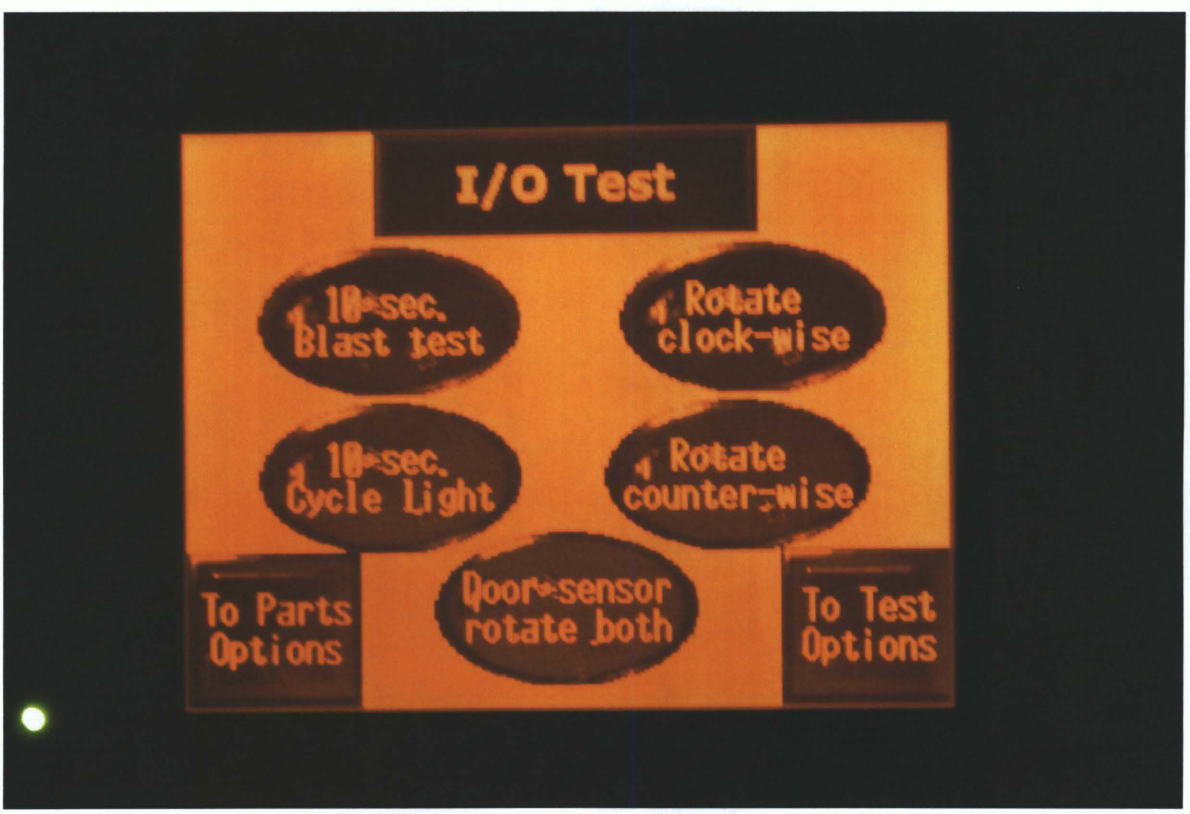

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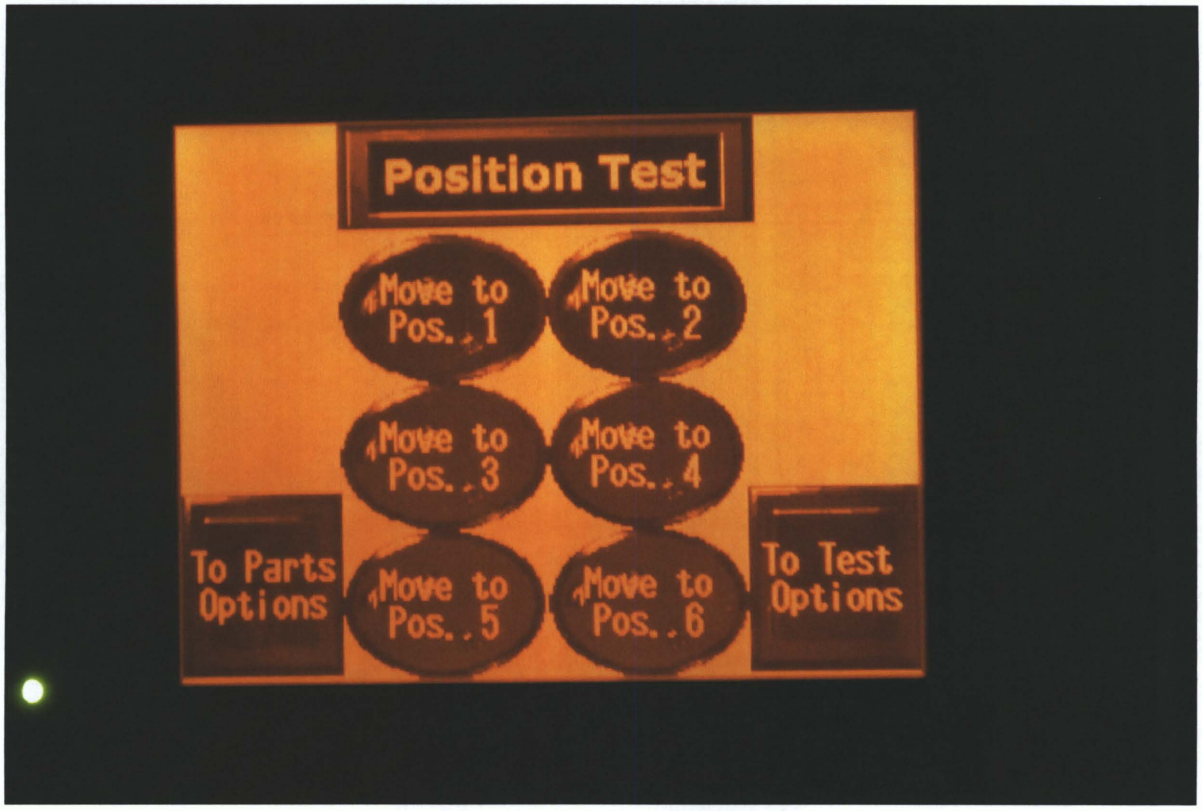

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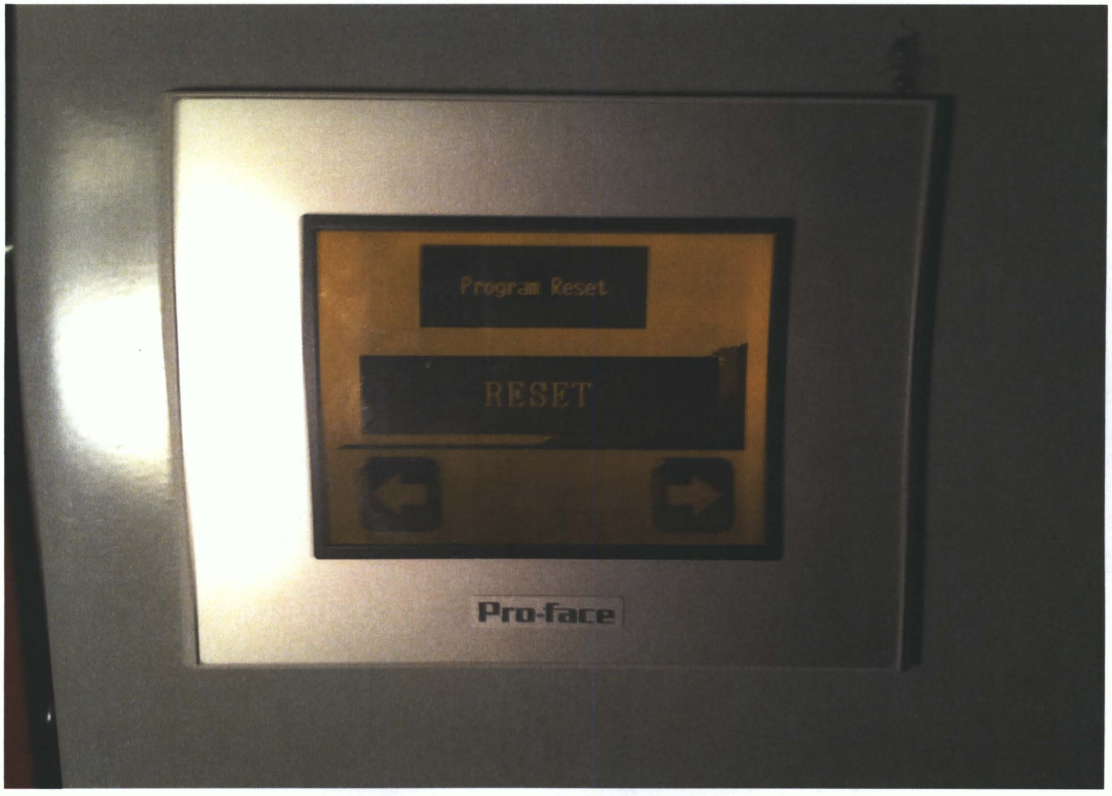

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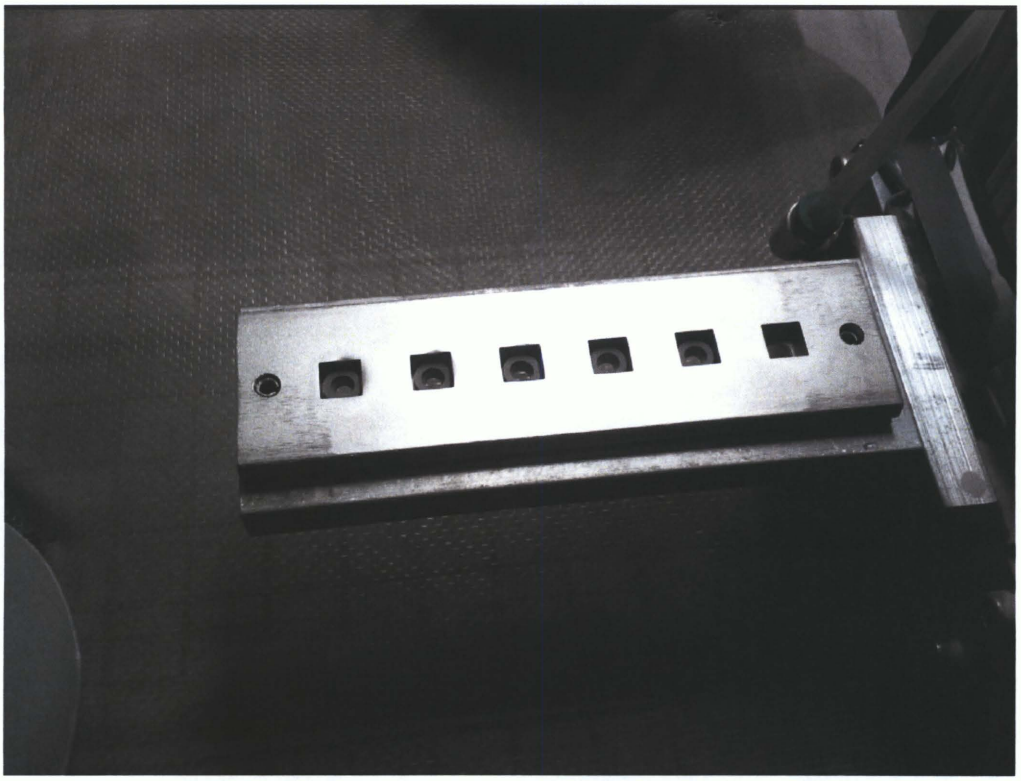
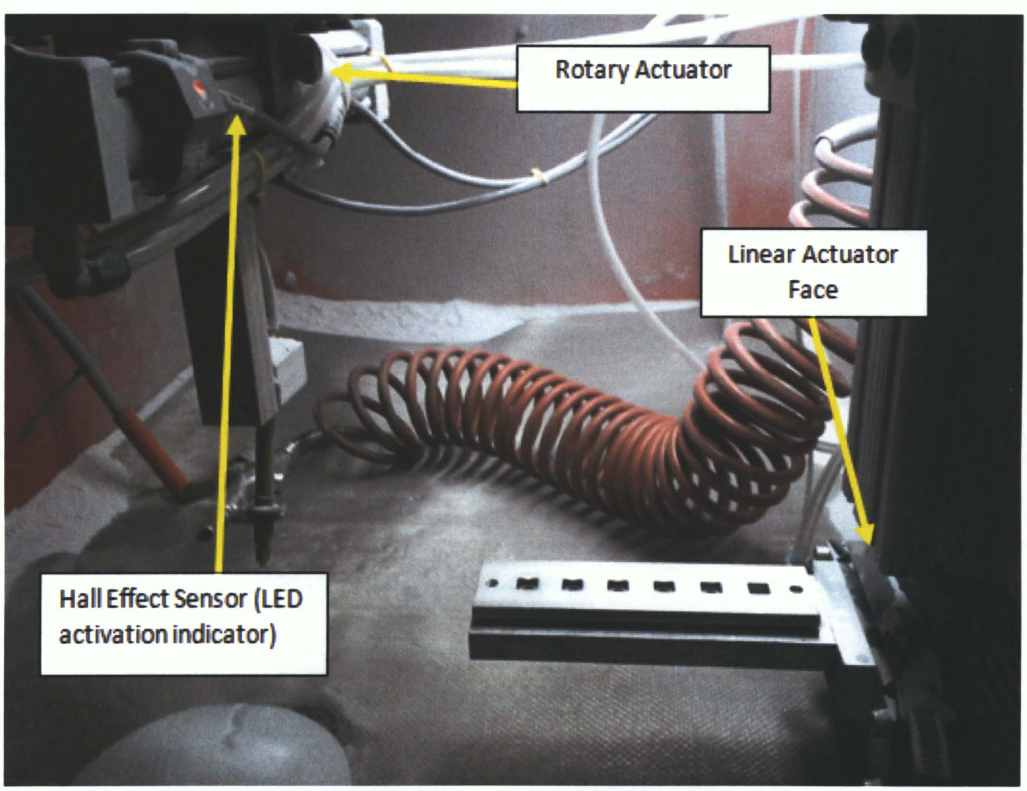


Figure 16: Picture of CNC diamond carbide mesh parts in automated sandblaster, aluminum interchangeable tray



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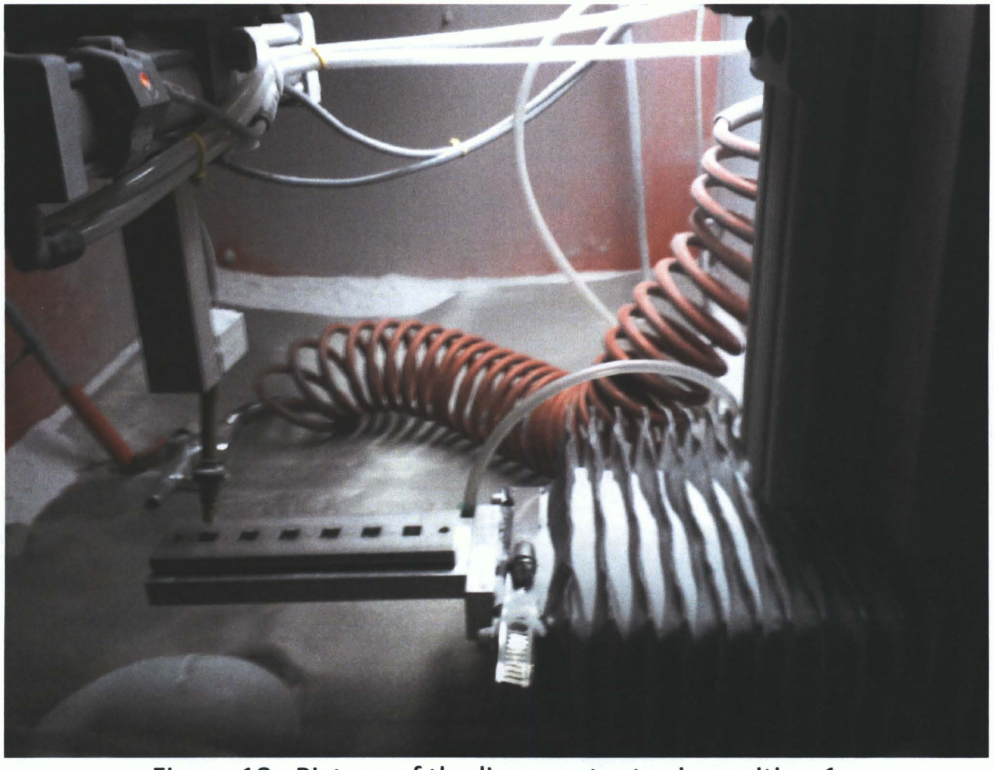

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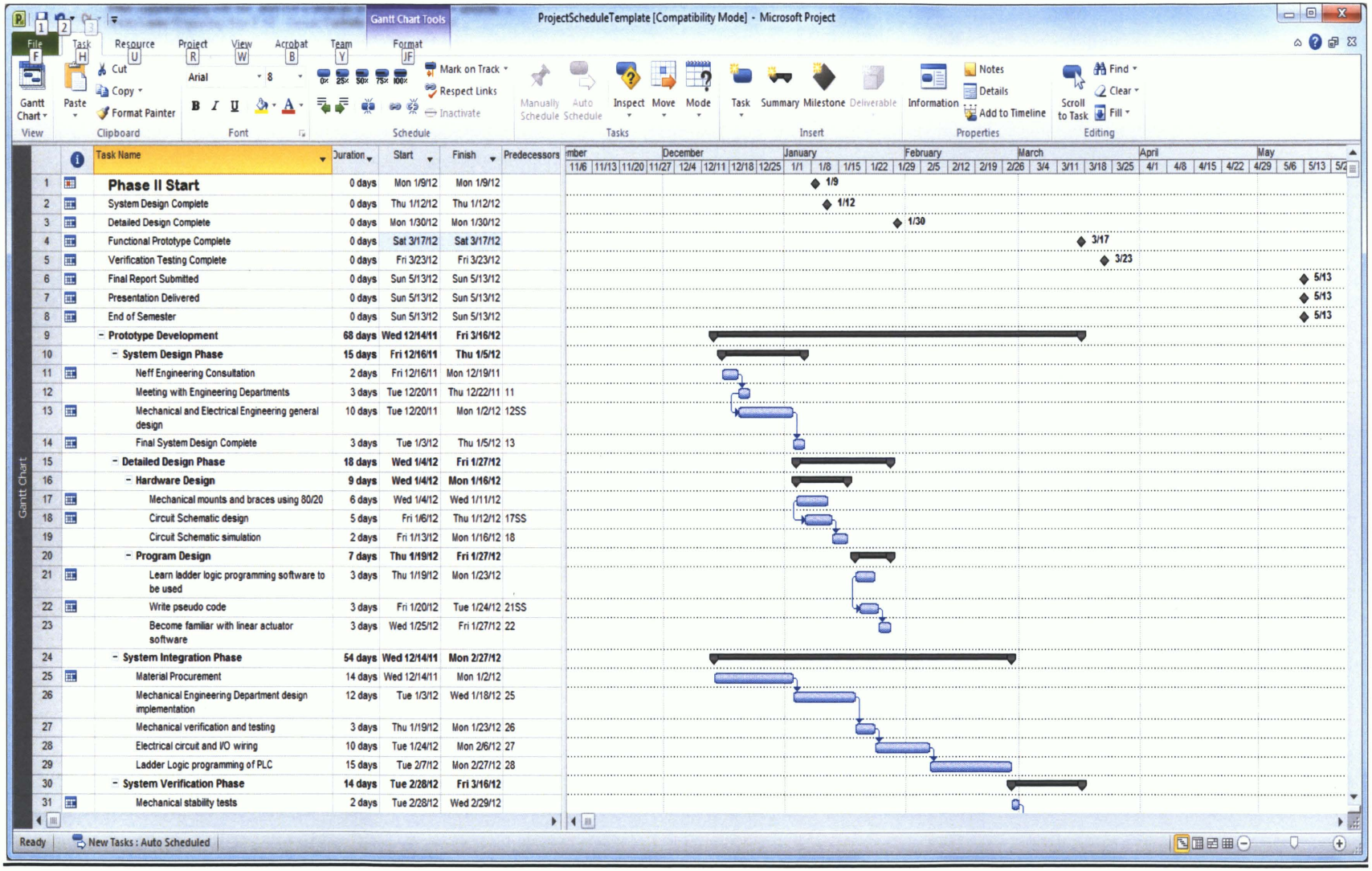
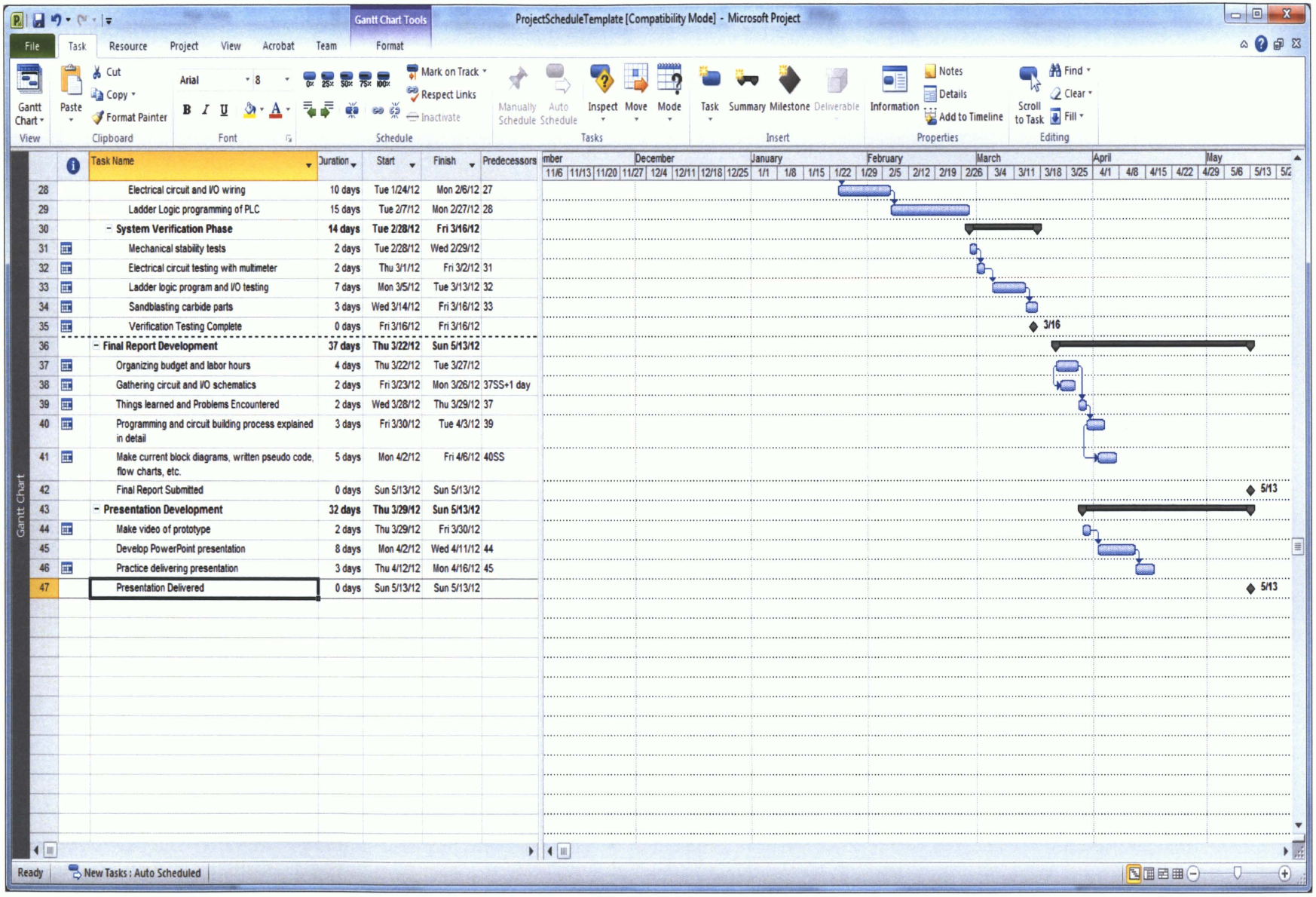


	Task Name	Duration	Start	Finish	Predecessors
1	**Phase II Start**	0 days	Mon 1/9/12	Mon 1/9/12	
2	System Design Complete	0 days	Thu 1/12/12	Thu 1/12/12	
3	Detailed Design Complete	0 days	Mon 1/30/12	Mon 1/30/12	
4	Functional Prototype Complete	0 days	Sat 3/17/12	Sat 3/17/12	
5	Verification Testing Complete	0 days	Fri 3/23/12	Fri 3/23/12	
6	Final Report Submitted	0 days	Sun 5/13/12	Sun 5/13/12	
7	Presentation Delivered	0 days	Sun 5/13/12	Sun 5/13/12	
8	End of Semester	0 days	Sun 5/13/12	Sun 5/13/12	
9	**Prototype Development**	**68 days**	**Wed 12/14/11**	**Fri 3/16/12**	
10	**System Design Phase**	**15 days**	**Fri 12/16/11**	**Thu 1/5/12**	
11	Neff Engineering Consultation	2 days	Fri 12/16/11	Mon 12/19/11	
12	Meeting with Engineering Departments	3 days	Tue 12/20/11	Thu 12/22/11	11
13	Mechanical and Electrical Engineering general design	10 days	Tue 12/20/11	Mon 1/2/12	12SS
14	Final System Design Complete	3 days	Tue 1/3/12	Thu 1/5/12	13
15	**Detailed Design Phase**	**18 days**	**Wed 1/4/12**	**Fri 1/27/12**	
16	**Hardware Design**	**9 days**	**Wed 1/4/12**	**Mon 1/16/12**	
17	Mechanical mounts and braces using 80/20	6 days	Wed 1/4/12	Wed 1/11/12	
18	Circuit Schematic design	5 days	Fri 1/6/12	Thu 1/12/12	17SS
19	Circuit Schematic simulation	2 days	Fri 1/13/12	Mon 1/16/12	18
20	**Program Design**	**7 days**	**Thu 1/19/12**	**Fri 1/27/12**	
21	Learn ladder logic programming software to be used	3 days	Thu 1/19/12	Mon 1/23/12	
22	Write pseudo code	3 days	Fri 1/20/12	Tue 1/24/12	21SS
23	Become familiar with linear actuator software	3 days	Wed 1/25/12	Fri 1/27/12	22
24	**System Integration Phase**	**54 days**	**Wed 12/14/11**	**Mon 2/27/12**	
25	Material Procurement	14 days	Wed 12/14/11	Mon 1/2/12	
26	Mechanical Engineering Department design implementation	12 days	Tue 1/3/12	Wed 1/18/12	25
27	Mechanical verification and testing	3 days	Thu 1/19/12	Mon 1/23/12	26
28	Electrical circuit and I/O wiring	10 days	Tue 1/24/12	Mon 2/6/12	27
29	Ladder Logic programming of PLC	15 days	Tue 2/7/12	Mon 2/27/12	28
30	**System Verification Phase**	**14 days**	**Tue 2/28/12**	**Fri 3/16/12**	
31	Mechanical stability tests	2 days	Tue 2/28/12	Wed 2/29/12	

Table 1: MS Project Schedule (1)



	Task Name	Duration	Start	Finish	Predecessors
28	Electrical circuit and I/O wiring	10 days	Tue 1/24/12	Mon 2/6/12	27
29	Ladder Logic programming of PLC	15 days	Tue 2/7/12	Mon 2/27/12	28
30	**System Verification Phase**	**14 days**	**Tue 2/28/12**	**Fri 3/16/12**	
31	Mechanical stability tests	2 days	Tue 2/28/12	Wed 2/29/12	
32	Electrical circuit testing with multimeter	2 days	Thu 3/1/12	Fri 3/2/12	31
33	Ladder logic program and I/O testing	7 days	Mon 3/5/12	Tue 3/13/12	32
34	Sandblasting carbide parts	3 days	Wed 3/14/12	Fri 3/16/12	33
35	Verification Testing Complete	0 days	Fri 3/16/12	Fri 3/16/12	
36	**Final Report Development**	**37 days**	**Thu 3/22/12**	**Sun 5/13/12**	
37	Organizing budget and labor hours	4 days	Thu 3/22/12	Tue 3/27/12	
38	Gathering circuit and I/O schematics	2 days	Fri 3/23/12	Mon 3/26/12	37SS+1 day
39	Things learned and Problems Encountered	2 days	Wed 3/28/12	Thu 3/29/12	37
40	Programming and circuit building process explained in detail	3 days	Fri 3/30/12	Tue 4/3/12	39
41	Make current block diagrams, written pseudo code, flow charts, etc.	5 days	Mon 4/2/12	Fri 4/6/12	40SS
42	Final Report Submitted	0 days	Sun 5/13/12	Sun 5/13/12	
43	**Presentation Development**	**32 days**	**Thu 3/29/12**	**Sun 5/13/12**	
44	Make video of prototype	2 days	Thu 3/29/12	Fri 3/30/12	
45	Develop PowerPoint presentation	8 days	Mon 4/2/12	Wed 4/11/12	44
46	Practice delivering presentation	3 days	Thu 4/12/12	Mon 4/16/12	45
47	Presentation Delivered	0 days	Sun 5/13/12	Sun 5/13/12	

Table 2: MS Project Schedule (2)

Project Resources Required

(Hours)

Tasks	Mike (Hours)	Lee (Hours)	Terry (Hours)	Todd (Hours)	Nate (Hours) (Non-project)
Consultation and parts ordering with Neff Engineering, Inc.	4	4	4		
Receiving of supplies ordered		2		2	
Mechanical Engineering design and schematics of cabinet layout		8		8	
Implementation of Mechanical Engineering design	4	20		20	
Electrical circuit design and schematics	15				
Implementation of electrical circuits	20	4			
Write pseudo code for ladder logic	8				
Write ladder logic program for PLC	55				
Test prototype	6	6		6	
Generate Final Report	8				
Generate Presentation	5				
Total Hours	120-140	44	4	36	40 non-project hours
Consultation and Advice	Phil Engle (Neff Engineering)		Estimated 10 hours		

Table 3: Project Human and Labor Resources Required for the Project (Initial Projection)

Project Material Cost

(Material)

Qty.	Description	Price Each	Total Net
1	SRD05-12-S-N-300, Electric cylinder with 300mm stroke.	$ 2,256.25	$ 2,256.25
1	KCA-M4966-00, TS Manager programming software	$164.00	$164.00
1	KCA-M538F-A0 programming cable	$240.00	$240.00
1	LT3201-A1-D24-C, 3.8" Operator interface/controller(PLC)	$465.00	$465.00
1	R13R2360-E, PHD rotary air over oil actuator, 360 degr. Rotation with magnetic piston for solid state switches	$667.95	$667.95
1	EXM-DRA16RT, Expansion Module	$120.00	$120.00
1	EX-ED-27, GP-PRO EX HMI & Logic Development software	$295.00	$295.00
1	CA3-USBCB-01, Transfer/Programming cable USB	$135.00	$135.00
2	17524-2, PHD solid state switch, 24 Vdc, PNP with quick connect	$65.55	$131.10
2	17000-32-5, PHD switch bracket	$6.55	$13.10
2	63549-02, switch cable, 2m	$23.95	$47.90
1	Mac 4-way double solenoid valve for rotary actuator	$47.65	$47.65
2	E45007-DA1K, mating cable for valve	$13.55	$27.10
1	Phoenix Contact Power Supply, 24Vdc, 5 Amp	$167.00	$167.00
1	1414N4PHM6, 12"W x 14"H x 6"D, electrical enclosure box	$162.96	$162.96
1	R18-02-F0G0 Regulator for Sandblaster wand	$42.08	$42.08
1	B18-02-FKG0, Filter/Regulator for Rotary actuator	$79.43	$79.43
1	AM-8-3, Aluminum Manifold	$13.47	$13.47
5	3175 56 11, straight push-in-fitting for filter/reg	$2.36	$11.82
5	3109 56 11, 90 degree push-in-fitting	$2.45	$12.25
6	3175 56 14, straight push-in-fitting	$2.36	$14.18
6	3109 56 14, 90 degree push-in-fitting for manifold	$2.71	$16.27
1	P18, 1/8" muffler for Mac valve exhaust port	$1.10	$1.10
Total Cost			**$5130.61**

Table 4: Project Material List and Cost Required for Project Completion